CLAIMS

1 A hot-chamber high-pressure diecasting method employing a fixed die, a movable die, a mould cavity formed between the fixed and movable dies, and a melt path comprising (i) a sprue channel formed in the fixed die for conveying molten diecasting metal from the hot chamber into the die, (ii) a runner channel formed between the fixed and moving dies at an angle to the sprue channel for conveying molten metal from the sprue channel into the mould cavity via a gate that is also formed between the fixed and movable dies, and (iii) a curved transition channel for conveying molten metal from the sprue channel to the runner channel through said angle; the method comprising the steps of:

heating the sprue channel to a temperature that is higher than that of the dies and approximating the melting point of the diecasting metal,

controlling the temperature of the dies so that they are below the melting point of the diecasting metal,

injecting a shot of molten metal into the sprue channel, transition channel, runner channel and mould cavity,

allowing molten diecasting metal remaining in the sprue channel to empty therefrom while allowing diecasting metal in the runner channel and in portion of the transition channel to solidify to form a runner and while allowing diecasting metal in the mould cavity to solidify to form a product,

separating the movable die from the fixed die, and

ejecting the product from the mould cavity together with the runner from the runner channel and portion of the transition channel.

2 A hot-chamber, high-pressure diecasting method comprising the steps of:

injecting a shot of molten diecasting metal through a gate into a mould cavity via a melt path comprising (i) a sprue channel formed in a fixed die and having an inlet opening in an exterior surface of said fixed die, (ii) a smoothly curved transition channel formed at least in part between said fixed die and a movable die that cooperates with the fixed die to form said cavity and said gate, and (iii) a runner channel formed between the fixed and movable dies, said runner channel extending between said transition channel and said gate,

heating said sprue channel above the melting point of the diecasting metal while maintaining the temperature of the dies below said melting point,

allowing molten diecasting metal remaining in the sprue channel and in portion of the transition channel after the shot to flow back out of the inlet of the sprue channel,

allowing diecasting metal in the runner channel, portion of the transition channel, and in the gate and the mould cavity to solidify,

separating the movable die from the fixed die, and

ejecting the solidified metal from at least one of the dies.

3 A method according to claim 1 or 2 including the step of:

uniformly accelerating the molten diecasting metal as it flows along the melt path, the uniform acceleration of the diecasting metal being enabled by uniformly reducing the cross-sectional area of the channels of the melt path in the direction of flow.

4 A method according to any preceding claim including the step of conveying the shot of molten diecasting metal in a smooth curve through an angle of approximately 90^{o} while it is within the transition channel.

5 A method according to any preceding claim wherein the transition channel is split so that a first part thereof is located by the fixed die and a second part thereof is located by the moving die, the method including the step of:

controlling the temperature of the second part of the transition channel independently of the temperature of the moving die so as to ensure that the freeze-point of the diecasting metal occurs within the transition channel after a shot.

6 A die-set for use in a hot-chamber, high-pressure diecasting process, comprising:

- a fixed die forming part of a mould cavity, part of a gate for admitting melt into the cavity and a runner channel for conveying melt to the gate, said fixed die having an exterior face,

- a movable die also forming part of said mould cavity, part of said gate and said runner channel,
- a sprue channel formed in the fixed die for conveying melt from the exterior face of the fixed die, the sprue channel being disposed at an angle to the runner channel,
- a curved transition channel formed between the fixed and the moving dies for conveying melt from the sprue channel through said angle to the runner channel when the dies are closed, and
- heater means associated with said sprue channel adapted to maintain the sprue channel near the melting point of the diecasting metal during operation of the die set.

7 A die set according to claim 6 wherein:

the sprue channel is formed by a first die insert that is fitted within the fixed die, said first insert having an outer end forming an inlet of the sprue channel on the exterior of the fixed die and said first insert having an inner end that forms a first part of the transition channel when the dies are closed, and

a second die insert is fitted in the moving die opposite the first insert, said second insert having an inner end which forms a second part of the of the transition channel when the dies are closed.

8 A die set according to claim 7 wherein:

said heater means comprises an electrical heating element formed around said first insert, and

cooling means are associated with the second insert adapted to cool said second part of the transition channel independently of said first die insert so that, in operation, the freeze-point of the diecasting metal can be made to occur within the transition channel.

9 A die set according to any one of claims 6 to 8 wherein the cross-sectional area of the sprue channel reduces uniformly in the direction of melt flow so that the velocity of the melt increases uniformly within the sprue channel during a shot.

10 A die set according to any one of claims 6 to 8 wherein the cross-sectional area of the portion of the melt path which comprises the sprue channel, the transition channel and the runner channel reduces uniformly in the direction of melt flow so that the velocity of the melt increases uniformly within said melt path.

11 A die set according to any one of claims 6 to 10 wherein said angle is substantially 90°.

12 A die set according to any one of claims 6 to 11 having an ejector pin slidingly located within one of said dies for movement into the transition channel so as to be adapted to eject diecasting metal that solidifies within the transition channel after a shot and after separation of the movable and fixed dies.

13 A sprue insert-set for use in a high-pressure, hot-chamber diecasting apparatus having a fixed die and a moving die having respective parting faces that cooperate to define a runner channel, a gate and a cavity, the sprue insert-set comprising:

a tubular sprue body insert forming a sprue channel and adapted for mounting within the fixed die at an angle to the parting face of the fixed die, said body insert having an outer end defining an inlet to the sprue channel adapted for location at an external surface of the fixed die, and said sprue insert having an inner end defining an outlet adapted for location in the vicinity of the parting face of the fixed die when the sprue insert is mounted within the fixed die,

heating means associated with the body insert for heating the said insert,

a first curved groove formed in the inner end of said body insert adapted to cooperate with a second curved groove associated with the moving die such that, when the body insert is mounted within the fixed die, said first and second grooves cooperate to form a curved transition channel connecting the outlet of the sprue channel to the runner channel when the dies are closed.

14 A sprue insert-set according to claim 13 wherein:

the sprue channel and the first curved groove are tapered uniformly in the direction of melt flow so that the velocity of the melt will increase uniformly as it travels from the outlet of the sprue channel to the runner channel when the insert-set is in use and the dies are closed.

15 A sprue insert-set according to claim 13 or 14 wherein said angle is substantially 90° and the first curved groove subtends substantially 90°.

16 A sprue insert-set according to any one of claims 13 to 15 wherein the sprue body insert includes temperature sensor means.

17 A sprue insert-set according to any one of claims 13 to 16 wherein the sprue body insert includes thermal insulation encompassing the heater means so as to mitigate the loss of heat from the sprue insert to the fixed die when the sprue insert-set is in use.

18 A sprue insert-set according to any one of claims 13 to 17 including:
a sprue tip insert adapted for mounting within the moving die, said tip insert having an inner end forming said second curved groove.

19 A sprue insert-set according to claim 18 wherein said tip insert includes cooling means associated with the tip insert whereby the tip insert may be held at a temperature below that of the sprue body insert when the insert-set is in use.

20 A sprue insert-set according to claim 18 or 19 wherein said tip insert includes temperature sensor means and thermal insulation adapted to mitigate thermal transfer between said second insert and the moving die.

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